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VOL. VIII. No. 2. JANUARY, 1931.

EDITORIAL.

AT the beginning of the year it is natural to look forward. If we do so as anæsthetists, and try to see the future of our speciality, we are puzzled at the present time by the many different lines along which progress is developing.

There has never before been a time when so many various drugs and methods were available as are now at the disposal of the practising anæsthetist. Indeed, it is hardly possible for one man to be expert with them all. Yet at the present day there is no single one of these which is superior in all circumstances. One thing appears clear. Perfect anæsthesia in the future is not likely to be achieved with anything like the simplicity that characterized the older methods. Nor is it likely to be an affair of one drug for one case. Will inhalation anæsthesia hold its place as the foremost method? Or will spinal injections supersede it with the aid of injected sedatives? Will the larynx always be eliminated, when inhalation is used, by the introduction of tracheal catheters? Will the rectum or the veins be the common route for introducing auxiliary substances? These are only some of the problems which will doubtless be solved in the future by some among our readers. The paths along which they are likely to tread are well indicated in the article which we publish from Dr. Torrence Thompson. We wish them well on their journey and hope often to record their progress in our pages.

RANDOM REFLECTIONS.

By Torrance Thomson, M.D.

(An address to the Scottish Society of Anæsthetists.)

THE chief function of a society such as ours, apart from its social one, is the promotion of interchange of opinions of varying kind and degree. The freer this interchange is the better will this function be fulfilled.

As we only meet once a year, it occurred to me that reference to a variety of subjects connected with our speciality might best promote this free interchange. Each of us, at any given time, holds certain opinions, has certain doubts and prejudices, has come to certain conclusions, tentative or otherwise. One has views on spinal analgesia, another on gas-oxygen, a third on surgeons, a fourth on pseudo-anæsthetists—views which he would, perhaps, like to ventilate. It is in the hope of stimulating you to speak your minds on any points that specially interest you that I present these reflections. It is a sort of variety entertainment, with, I hope, a certain continuity running through it.

ANÆSTHESIA AND ANÆSTHETICS.

We might begin by asking ourselves to what position our speciality has attained, what position we ourselves occupy as specialists in anæsthesia, and, in general, what the future has in store.

I think you will agree that we are passing through a phase of great activity. The older methods are being called upon, more and more, to fight for the place they have held so long. New methods and new agents are being introduced with almost embarrassing frequency, are weighed in the balance by us, and in due course either disappear or take a definite place. This is as it should be.

After all, we achieve our anæsthesia or analgesia by the administration of poisons, and must ever search for agents

or methods which, while conforming to the requirements of the surgeon for operation facility, are immediately safer and less deleterious in their after effects. In other words, we must continue to search not for one ideal method, but for methods and agents that are superior to those we already possess.

This healthy activity has, to a certain extent at any rate, stimulated the interest of the surgeon, and it is probable that he is definitely, if gradually, coming to attach to anæsthesia that importance to which we, as specialists, feel that it is entitled. It cannot be too often stressed that without the surgeon's co-operation we can do comparatively little beyond saturating our patients with ether or chloroform. We, of course, know this; it is a fact which is constantly obvious to us. Unfortunately, in the past, it has not been so apparent to the surgeon.

When, however, he develops an interest in anæsthesia he soon comes to appreciate the importance, or rather the necessity, of co-operation, and satisfactory work becomes more possible to the anæsthetist.

Ours is a comparatively young speciality, and old traditions have a strong hold. The tradition that any qualified medical man can give an anæsthetic, with as much satisfaction to the surgeon and as little detriment to the patient as a trained anæsthetist, is dying a lingering death, but it is dying, and we, while possessing our souls in patience, can perhaps best hasten that consummation by going on quietly with our jobs. It is certain that the day is not far distant when advantage will always be taken of the services of an anæsthetist when they are available.

A fuller recognition of the importance of the anæsthetist will result in a change in his status at hospitals, a point of importance which, however, I must only mention. In this connection I may, perhaps, refer to a letter in a recent issue of the *British Journal of Anæsthesia*, in which the question of emergency anæsthesia in hospitals, is ventilated. This has long been a matter calling for attention. The problem is excellently summarised in an Editorial in the same number; the solution of the difficulty, however, is far from easy.

It is tempting, though, of course, difficult, to speculate about the future. There is apparent at present a widespread

tendency to get away from inhalation anæsthesia pure and simple; either to assist it, so that the amount of inhalation anæsthetic required is markedly limited, or to replace it altogether by other methods. Dr. McKesson in this connection said: "We had come more and more to rely upon the multiplication of anæsthetic agents in the attempt to produce balanced anæsthesia."

It is only necessary, in support of this contention, to mention splanchnic analgesia, colonic oil-ether anæsthesia, avertin rectal narcosis, spinal analgesia with novocain, stovaine, spinocain, and percain, intravenous narcosis with sodium amytal and pernocton, in addition to other local and regional methods.

The reasons for this tendency are not far to seek. Although the anæsthetist is often made the scapegoat, and held unduly responsible for much that happens post-operatively, there can be no doubt that inhalation anæsthesia, especially that effected with ether and chloroform, has its disadvantages and dangers, more especially, perhaps, in the post-operative period. It is unnecessary to elaborate this.

It is to be remembered also that in such operations as those on the upper abdomen, adequate relaxation necessitates, in most cases, a profound degree of anæsthesia. Finally, although a rare occurrence with skilled administrators, sudden death during administration may occur.

Briefly put, what we are searching for is an agent or a method, or a combination, which will:—

1. Be immediately safe.
2. Give adequate operation facility.
3. Be free from post-operative ill effects.

In addition we would prefer the patient to be unconscious, or to have his sensitiveness so dulled that he is impervious to psychic trauma. This is, of course, an ideal, but it is an ideal towards which we must strive.

The tendency to get away from inhalation anæsthesia is by no means new. During many years there have always been a few local anæsthesia enthusiasts who either depended on local infiltration alone, with perhaps a preliminary dose of morphia, or combined local infiltration with a light general inhalation anæsthesia, as in Crile's Anoei-Association method.

The intravenous method was first used about 25 years ago, with ether, and a little later with hedonal. The former had no apparent advantages over ether with inhalation, and several fatalities occurred after the use of hedonal, which made its further use unjustified.

Colonic oil-ether, introduced by Gwathmey, has now had an extended trial, and has won a place as an approved method. It has undergone considerable elaboration and exemplifies the tendency to the multiplication of anæsthetic agents. It seems probable that this method has not received the attention to which its merits entitle it, in this country at any rate.

The dependence on paraldehyde as the chief agent in rectal anæsthesia has not proved satisfactory, though as an adjunct to colonic-oil-ether it has been found useful.

In the meantime there has been a marked increase in the use of local anæsthesia, and a great extension in the use of regional analgesia. Regional analgesia may possibly require special study and a prolonged training, and in the future there may be specialists who will confine themselves to regional work. Indeed, I gather that this has already taken place in America.

A few years ago a form of regional block called splanchnic analgesia was introduced into this country, from Vienna, by Drs. Hillman and Apperley, who reported favourably on the method for abdominal work.

A trial of it in the wards to which I was attached proved unconvincing, and it is unlikely, I think, that much will be heard of the method in the future. I cannot, however, speak with any knowledge of the extent to which it is still used.

A glance at the history of the introduction of these various methods is instructive and should put us on our guard against premature enthusiasms. The habitual sceptic is a tiresome person who is often, at heart, both lazy and jealous—but adequate scepticism is very desirable.

At present anæsthesia by the rectal administration of avertin is on its trial. The history of this trial is full of interest.*

In 1928 there was published in "Narcose and Anæsthesie"

*Reference here is to avertin used as the basal anæsthetic.

a paper by Dr. Hans Killian on avertin-rectal narcosis. This was based partly on personal experience, partly on a review of clinical and experimental records drawn from a large number of sources.

The conclusion set forth was as follows:—"An anæsthetic must guarantee the greatest possible safety. In this respect, avertin-rectal narcosis cannot in the least compare with other anæsthetics—Too high doses are necessary." Notwithstanding this adverse criticism, a further trial was given, and with this extended experience, certain modifications in dosage and technique were introduced, with the result that the use of the method in several German clinics became established. To what extent it is used at the present day in Germany I do not know.

In March, 1929, a paper was published in the *Lancet*, embodying a report on the use of avertin as a rectal anæsthetic. Sir Francis Shipway, Dr. Blomfield, and one or two others, carried out a test of the drug at the request of a joint committee of the Medical Research Council and the Section of Anæsthetics of the Royal Society of Medicine. The report was based on a trial in 198 cases and was a very favourable one. It stated that with patients of all ages and in all conditions of health or sickness, and in a great variety of operations, the results were uniformly satisfactory. They found "no untoward effect on the circulation or respiration . . . A slight fall in blood pressure, usually about 10 m.m. Hg. . . The blood pressure never fell more than 30 m.m. Hg. unless the severity of the operation itself produced a fall." It was a report that tempted one, in so many respects did it seem to be ideal. We forthwith began a trial of the method in Professor Fraser's wards in the Royal Infirmary, Edinburgh—using a technique similar to that employed by Sir Francis Shipway and Dr. Blomfield. At the start we used a dose of 0.1 gramme per kg. of body weight and gave a sixth of a grain of morphia beforehand. After the first few cases, in view of the fall in the blood pressure and some respiratory depression, the dose was reduced to 0.08 per kg. and the morphia was omitted.

Our experience was limited to 35 cases. Probably we ought to have persevered, but we found the anxiety too great

and decided to "wait and see." In the first case I spent a most uncomfortable half-hour at the bedside of the patient, a woman of 50, who had a small malignant growth of the lower jaw, but whose general health was apparently good. The blood pressure fell steadily during the course of the hour following the injection from 180 systolic to 60 systolic, with a corresponding fall in the diastolic. The pulse-rate did not alter much. Ephedrine was given intramuscularly and, as there was considerable respiratory depression, oxygen and carbon dioxide were administered. At the end of half an hour the condition began to improve, and in an hour had improved sufficiently to justify the operation, which was by no means a severe one, and from the effects of which the patient made a good recovery. In several of our cases the fall in blood pressure was considerable and there was respiratory depression sufficient to produce a certain degree of cyanosis. In the last case of the series we had to deal with a strong young man on whom an operation was performed for a deformity of the foot. His blood pressure fell during the operation, though not to an alarming extent. In the hours following the operation, his respiration was markedly depressed and his condition gave the house-surgeon considerable anxiety.

I have gone into some detail because of the sharp contrast between our experience and that reported in the *Lancet*. It is a little disquieting that such a contrast should be possible. We examined our technique with great care in case we were going astray in some respect, but with no result. In our brief experience the method failed to give the degree of immediate safety which is essential. Personally I was disappointed and puzzled; and I continued in that condition because Sir Frances Shipway, though he, perhaps, does not write with the same enthusiasm, still throws the weight of his authority on the side favourable to the use of the drug. Moreover, Dr. James Young, working in the gynæcological wards of the Edinburgh Royal Infirmary, has been so favourably impressed that he uses the method as a routine in a certain class of cases, and after an experience based on nearly 1,000 anæsthesias is still an enthusiast.

I, personally, look forward with great interest to the future history of avertin.

The advocacy by Dr. Pitkin of his method of using novocain for spinal analgesia has had, at any rate, one good result, in that it has greatly stimulated interest in this form of anæsthesia. Whether spinocain anæsthesia has any special merits, whether it really satisfies the claims made for it, remains to be seen. The method, at present, is receiving an extensive trial.

Following closely upon this, came a new agent called percain, which was introduced into this conutry for local and spinal analgesia. Its use in the latter was tested and is at present being tested by Dr. Howard Jones,* who conceived and developed a special technique based on his theory of action. This method is also receiving an extended trial.

In the near future we will be able to assess the value of these methods. Up to recent times, spinal analgesia has never been generally popular and can hardly be said to have previously received the fair trial that is now being accorded it. The impetus which is evident is partly due to the introduction of spinocain and percain, partly to the tendency to which we referred—to get away from dependence on inhalation anæsthesia.

Personally I can speak from a certain experience of percain, though that experience is still inadequate for definite conclusions. I may say that, as far as conclusions have taken definite shape, I think that spinal analgesia with percain gives to the surgeon a high degree of operation facility. In high abdomen operations, for instance, I know of no other method which will give greater relaxation. The post-operative condition of the patient, also, is satisfactory, there is little sickness, an absence of pulmonary complications, and the general condition of the patient is, as a rule, very good.

The question of adequate immediate safety is still unsettled. It is one which is difficult to assess, and a large number of cases will have to be recorded before anything in the way of a definite answer can be given. I think it may be said that the place that percain will occupy in future will

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depend on this question of safety. That is all that can be said at present.

In concluding this review of recent tendencies, I will merely mention the intravenous injection of such drugs as sodium amytal and pernocton. It is not claimed that these replace other methods, but that, as with avertin, they produce such a profound narcosis as to permit a great limitation of their use.

The future is full of interest and perhaps, we may say, of promise. The difficulties of arriving at a correct estimate of the value of any particular agent or method seem to me to be very great apart from an extended personal experience, and obviously there are limits to the possibilities of this. At present it seems to happen that while we are testing one method one or two new ones are introduced—a state of things which induces a condition bordering on bewilderment. It is almost with a feeling of relief that we turn from this welter of comparatively unfamiliar acquaintances to our old friends, the inhalation anæsthetics.

With the exception of ethelene, no new agent of imporance has recently been introduced.

Of the methods of inhalation anæsthesia, it seems certain that one, at least, will survive. I refer to gas-oxygen. By gas I mean either nitrous oxide or ethelene. Its comparative harmlessness and safety, the rapidity of recovery, and the freedom from post-operative discomfort, will ensure for it a permanent place either as the chief agent, or as an adjuvant.

I have an impression that gas oxygen anæsthesia in this country has had to encounter prejudices which have precluded the extended trial it merits. These prejudices tend to a certain disinclination, and it may be of interest to consider what are the possible factors concerned, mindful of the fact that they may, for the most part, act unconsciously.

Obvious factors are the cumbersomeness of the apparatus which, often a a moment's notice, has to be transported to the nursing home, and the fact that the expense involved is considerably greater than with other methods. Then there is the difficulty of administration. Of all methods it probably calls for the greatest skill.

I think, however, that the factor acting most powerfully

is the unpleasant feeling that we may be called upon by the surgeon to achieve the impossible. I have in mind abdominal operations, especially operations on the upper abdomen. Surgeons as a class, do not seem to have grasped either the limitations or the implications of gas-oxygen anæsthesia. They have grown accustomed to the flaccid abdomen of deep etherisation in which they can roam freely without troubling much about the effect of their stimuli. With gas-oxygen anæsthesia, except in particular favourable cases, this is not possible unless considerable quantities of ether are given. Such, as any rate, has been my experience.

It seems to me that if gas-oxygen anæsthesia is to have a fair chance in abdominal surgery the surgeon must, in the first place, reduce his demands as regards relaxation; secondly, he must remember that he has a narrow zone of anæsthesia on which to draw, and that any extra stimulus may bring the patient outside this zone. He must, therefore, go hand in hand with the anæsthetist, like two burglars entering a room where the occupant is asleep, conscious that any slip or clumsiness on the part of either may at once interfere with the smoothness of the job.

To sum up, then, the conditions essential to successful gas-oxygen anæsthesia are:—

1. A satisfactory apparatus.
2. Adequate skill on the part of the anæsthetist.
3. An understanding surgeon.

If these conditions are fulfilled, the employment of the method, in selected cases, is a great advantage to the patient.

And what of the old brigade? (I refer, of course, to ether and chloroform.)

There is still prevalent, outside Scotland, a belief that chloroform is, with us, the anæsthetic of choice. This is comparable to the belief that we all wear kilts, and subsist on haggis, porridge and whisky. It is true that most of us make a moderate use of these commodities; it is also true that we make moderate use of chloroform. But it is a fact that as far as inhalation anæsthesia is concerned, ether has stepped into the place once occupied by chloroform and that the latter is only used in very limited quantity as an adjuvant, or in

exceptional cases where the other inhalation agents are contra-indicated.

It is probable that the use of ether will continue for a long time to come. In considering results, too little attention has been paid in the past to the difference between skilled and unskilled administration.

Many of us are prejudiced in favour of inhalation ether anæsthesia with or without the aid of chloroform. It is an old friend, its effects are to a large extent controllable, and its administration calls for skill and tact. Its immediate safety in skilled hands is great and, although its after-effects are not predictable we know that much depends on the way we have conducted the induction and maintenance—and so we have the opportunity of exercising what skill we possess. Although its position is being challenged, it has never yet been seriously threatened. It is probable that in time it will be to a large extent superseded, but it may be a long time before that takes place. In the meantime we should welcome any adjuvant which enables us to lessen the quantity of ether used, for there is no doubt that saturation with ether produces very undesirable after-effects.

This then, is in brief, the conclusion of my reflections.

We are at present passing through a stage of great activity. New agents, and methods, the number of which is almost embarrassingly large, are on trial. Though some of them hold out a promise, none has yet established itself to such an extent as to endanger, immediately, the position of the other inhalation methods.

It seems certain that gas-oxygen anæsthesia will maintain its position. On the other hand, it is not unlikely that in time ether will be superceded.

I suppose, in these days our speciality must share the fate of so many other things and become increasingly mechanised. Conceivably, too, the anæsthetist as he exists to-day, will depart, along with his ether apparatus and accompanying gadgets. If he is to survive, he must be prepared to qualify himself for whatever change may come and accommodate himself to inevitable modifications.

THE BLOOD PRESSURE IN AVERTIN ANÆSTHESIA.

By WALTER P. KENNEDY (Beit Memorial Research Fellow).

(From the Department of Physiology, Edinburgh University, and the Royal Infirmary of Edinburgh.)

AVERTIN anæsthesia has already a very extensive literature and its technique and properties have been widely discussed. Among the latter is one which has aroused considerable objection to the use of this new anæsthetic, namely that of producing a fall in blood pressure. This fall is of almost invariable occurrence and has been stated to be from 15 to 20 mm. of mercury, though Church[1] gives 30 mm. as the figure. In a preliminary communication[2] on a series of 36 cases we stated the figure was even higher but that no untoward effects accompanied the fall. A more extended experience of 150 gynæcological cases has amplified our data.

The following details of technique are briefly stated, as discrepancies in the results of different workers may be due to variations of procedure. The avertin is made up in $2\frac{1}{2}$ per cent solution of the fluid preparation (solid avertin in amylene hydrate) to a dosage of 0.1 gm. per kilo body weight. Tap water at body temperature is used, and the solution tested with Congo red. The preparation is done by the anæsthetist, and the actual administration to the patient in bed is carried out by a senior nurse specially instructed in the method. In no case was there any excitement stage during the induction. Prior to the instillation, which occupies from five to ten minutes, $\frac{1}{8}$ gr. morphine hydrochloride and 1/100 gr. atrophine sulphate are given hypodermically. The avertin should be administered at least half an hour before the start of the operation, as otherwise the patient is apt to be easily aroused. Undue disturbance of the patient in the early stages should be carefully avoided for this reason. Certainly, smoothness of induction has a very beneficial effect on the course of the

subsequent anæsthesia; those patients who happen to be disturbed in the early stages are more liable to give trouble later. If the exigencies of operation day routine cause a further delay of half an hour, or perhaps even more, no difficulty arises.

The patient is removed to the ante-room, the reflexes are examined and open ether commenced. It should be emphasised that avertin is used as a basal anæsthetic, and ether is employed as a routine. In five cases of the series the avertin alone was sufficient and no ether was given; these were all minor operative procedures or examinations under anæsthesia. From this point it is necessary to have a cylinder of oxygen containing five per cent CO_2 at hand as a respiratory stimulant, as some inhibition of the respiratory centre tends to occur. This has always responded so readily to the stimulating action of CO_2 that it has not occasioned any anxiety, but the availability of this agent should be a necessary condition in the use of avertin. It is also advisable to have a solution of ephedrine hydrochloride at hand (50 mg. per c.c.) for administering hypodermically in doses of $\frac{1}{2}$ c.c. to counteract the fall in blood pressure. Ephedrine is chosen rather than adrenaline, as the effect is more lasting although it is not produced with such rapidity. A mixture of the two substances should be useful, but we have no personal experience of it. The blood pressure was measured with a Baumanometer, using the auscultatory method, special care being taken to avoid fallacies.

The usual sequence of events is that the patient is asleep by the time the instillation is complete, or at least within the next five minutes. The pulse rate rises, the face becomes slightly flushed, and the blood pressure falls gradually, reaching the lowest point in about twenty minutes to half an hour, and if undisturbed the patient remains at this level for a considerable period. In the majority of cases the systolic pressure falls more than the diastolic, or, in other words, the pulse pressure is diminished. The administration of ether produces an immediate rise in both pressures and usually an increase in pulse pressure. This sudden rise may or may not be sustained, and it is more than probable that the nature of the operative procedures has an influence in this respect. For example, in the majority of the cases of abdominal section it

was observed that the systolic pressure fell sharply immediately the peritoneum was opened; similarly, in the case of pelvic floor repair a pressure which has been maintained fairly steadily during the anterior colporrhaphy will almost invariably fall 15 to 20 mm., or even more, with the commencement of the posterior colpoperineorrhaphy. After the rise due to the ether there may be a further rise, even above the pre-anæsthetic level; the level may be sustained steadily or irregularly or there may be a fall: individual differences are considerable. In nearly every case the *status quo* is maintained for some hours after the patient is returned to bed. From six to eight hours, or longer, after the operation consciousness returns, although the patient is drowsy and practically automatic. The next day there is little or no memory of events of the previous evening. The blood pressure twenty-four hours after the operation is commonly below the preoperative level by 10 to 20 mm. Sickness is present in just less than one-third of the cases, but it is usually slight and of short duration. It does not occasion so much complaint as the headache which occurs in about half the patients. This is readily controlled by pyramidon gr. v (repeated after four hours if necessary, though one dose usually suffices). Bronchial sequelæ are absent. This, with the relative freedom from sickness, is particularly valuable in cases of pelvic floor repair. The ether required to obtain the requisite level of surgical anæsthesia is given with an ordinary Schimmelbusch mask, and the mask concentration is never so high as with ordinary inhalation anæsthesia.

In reading the blood pressure it is observed that the quality of the Kortokov sounds fluctuates considerably in individual cases, and variations from the normal inter-relations of the sounds are common. Frequently the clear slapping third sound merges gradually into the dull fourth instead of giving the sudden drop of tone and intensity normally found. This makes the estimation of the diastolic sometimes difficult; nevertheless, rarely is it impossible to detect a point where a definite change occurs. In four of the cases there was an apparent drop of the diastolic to zero; that is, when the armlet of the sphygmomanometer was completely deflated or, indeed, removed it was still possible to hear the third sound (or a

continuation of it) in the artery. One of these cases (No. 81) is shown in Fig I, and the diastolic is charted as reaching zero: this must be understood to represent the apparent reading and not the true condition of the artery. In three other cases the diastolic fell below 20 mm. mercury, and in several others it passed the 40 mm. level, which is supposed to be incompatible with life. These readings occasioned considerable apprehension and ephedrine was administered; at the same time the accuracy of the figures was checked by an independent observer. However, the patients uniformly had a good colour and their breathing was easy, quiet, and rather shallow than deep—they appeared to be comfortably asleep. At the same time the pulse was very rapid, 120 to 140 per minute, and the skin flushed and hot. Sweating, in many instances, was profuse, but this is a phenomenon in the operating theatre in summer not confined to patients. The exhibition of ephedrine rapidly restored the pressure to more usual levels and coincidently the pulse rate fell. Increase of pulse rate was always found with avertin, and this was found to be higher than the first series of cases had indicated. As the rate fluctuated considerably it would require rather complicated methods to give an exact picture of the average increase: instead, the average of the highest recorded point in each of the cases has been calculated. These highest points ranged between 84 and 152 per minute, and the average was 122 per minute.

Similarly, taking the fall in blood pressure, the greatest drop of the systolic level from the pre-operation figure varied between 2 and 102 mm., with an average value of 41 mm., but in only nine cases out of a hundred and fifty was the fall less than 20 mm. The greatest diastolic drop varied between 0 and 80 mm, and the average was 28 mm., which would not have been so great but for the exceptional cases mentioned above. These figures give no true indication of the decrease of pulse pressure, as the points of greatest diminution of systolic and diastolic pressures are not necessarily contemporaneous; indeed, they are seldom so. The general tendency is for a lessening of the pulse pressure, but occasionally (as in the anomalous cases such as No. 81) it is apparently greatly increased. A similar example is seen in Fig III, in which the recorded pulse pressure of the cat increased six-fold. In con-

nection with these figures it may be added that the average duration of the operation, excluding preliminary ether anæsthesia, was 14.5 minutes, or, including this, almost 20 minutes. The average amount of ether used was $2\frac{3}{4}$ ounces, and this figure is probably somewhat in excess of the absolute requirements.

It should be emphasised that the clinical condition of the subjects who exhibited the high pulse rates and low pressures was good, and ocular observation gave no cause for anxiety. A number, however, showed marked cyanosis and greatly depressed respiration, apart from such unusual fluctuations as have just been mentioned. As has been said, CO_2 and oxygen rapidly restored normal colour. Latterly the number of these cyanotic cases had been reduced by the routine usage of an airway. The lower jaw is very lax under the influence of avertin, and unless this precaution is adopted constant observation is requisite.

Cases of this series have been given avertin despite the presence of valvular murmurs, and none of them gave any cause for anxiety or exhibited ill effects later. In view of the results obtained in the theatre and experimentally, however, it is considered that myocarditis and auricular flutter should be taken as contraindications to the use of avertin.

In the series of 150 cases one death occurred, and the responsibility cannot be laid on the anæsthetic. The patient was a short, very obese woman, aged 40, weighing 12 stone $10\frac{1}{2}$ pounds, and the operation was for removal of a big and difficult fibroid and repair of a large hernia. It lasted $1\frac{3}{4}$ hours, $12\frac{3}{4}$ ounces of ether being used, and oxygen being administered throughout. The systolic pressure fell from 150 to 108 mm. and the diastolic from 84 to 68 mm. before the operation. On the administration of ether being started they rose to 134 and 84 mm. respectively, and were maintained, fluctuating only slightly, about that level during the operation. The patient died that night. She was a bad operation risk, and the result with any anæsthetic would probably have been the same.

The operations for which the anæsthetic was given were as follows:—Dilatation and cauterisation of the cervix, 55; dilatation and curettage (diagnostic and therapeutic), 19;

pelvic floor repair, 24; insertion of radium, 12; removal of fibroid (1 with additional hernia), 8; hysterectomy, 7; incomplete abortion, 6; diagnostic examination, 4; laparotomy, 4; insertion of tents, 2; tubal insufflation, 2; appendicectomy, 2; and one each, removal of vaginal papilloma, repair of urethral fistula, Gilliam, pelvic sympathectomy, and simple dilatation of cervix.

In the wards in which this investigation was carried out up to date avertin has been used in 734 cases, and there have been four deaths, none of which could be ascribed to the anæsthetic. A full report of the series will be published when a thousand cases have been obtained.

It was thought well to investigate the physiological aspect of the great apparent fall in diastolic pressure. A search through the literature yielded little help, save in a paper by Davies and Holmes[3] who studied the effect of warm immersion baths on the circulation, and who describe a similar drop of the diastolic to zero which appeared to be associated with a diminution of peripheral resistance and some alteration in arterial elasticity. We therefore made a series of observations on healthy young adults exposed to great external heat, and used a Turkish bath for the purpose. The record of one typical experiment is given in Fig. II. The blood pressures and pulse pressure first fell; but after almost half an hour, and the increase of temperature to 164°F., the pulse pressure and rate increased, the diastolic pressure falling, and on the temperature being raised to 194°F. the diastolic reached 40 mm., while the pulse was 143 per minute. The subject sweated profusely and felt no distress, indeed he could only be persuaded with difficulty to leave the hottest room. One other subject became readily distressed; his pressure, after a small preliminary fall, rose to 32 mm. above normal, and his pulse rate rose also.. It was observed that he scarcely perspired, and therefore the experiment was not proceeded with in his case. In one of the series a zero diastolic reading was obtained, but it is not figured, as the observer doubted its reliability owing to the fact that the great heat caused such loud carotid pulsation in his own ears when the stethescope was applied, that it was extremely difficult to be certain of the sounds in the brachial artery.

Only ten such experiments have been conducted so far, but sufficient data has been obtained to make it clear that a very considerable temporary drop in blood pressure can be tolerated without ill effect. The main factor responsible for the fall is the great vasodilation due to the activity of the heat-regulating centre; at the same time it is probably not the only one. The great increase in heart rate is consistent with such a fall, and when the efficiency of the cardiovascular system is not seriously impaired by disease it appears to be able to cope with the situation easily. Of course, in a Turkish bath no physical work is done and the supine position is assumed, both conditions also obtaining in the case of anæsthesia. The beneficial effects, with sensation of euphoria, after a Turkish bath are well known, and it is also a commonplace that they are inadvisable for people who suffer from what the laity call "weak hearts."

A number of acute experiments were performed on cats and rabbits, and the results are parallel to those found clinically. In the case of rabbits a soft rubber catheter can be inserted into the bowel readily and anæsthesia induced in two to three minutes without any struggling or excitement of the animal; cats, however, resent this treatment and are therefore first lightly anæsthetised with ether and then brought under the influence of avertin. It was found to be an admirable anæsthetic for long continued experiments, and the fall of blood pressure and diminution of respiratory movement was easily counteracted by the use of ephedrine. The figure shows the increase in blood pressure and diminution of pulse pressure with the deepening of respiration—which has become shallow with avertin—when the ether was reapplied. In several experiments the blood pressure was allowed to fall without interference; but in doses of up to 0.2 gm. per kilo, after a period of approximately one hour the pressure rose slowly. The anæsthesia in some of the animals began to be light at this point and further doses were injected. Some experiments were also performed with intravenous administration of the solution, which showed more rapid onset of the effects.

In a recent report of the Council of Pharmacy and Chemistry of the American Medical Association[4] the advantages claimed for avertin are listed as follows:—

1. Absence of so-called psychic shock or mental distress (authorities are almost unanimous). 2. Absence of irritation of the respiratory tract, with less post-operative bronchitis and pneumonia. 3. Absence of direct injurious action on the heart, kidneys, or other organs, with the possible exception of the liver. 4. Convenience for operations about the face, especially when a cautery must be used. 5. Usefulness in long operations when deep anæsthesia is not necessary. 6. Less frequent vomiting than after ether or chloroform. 7. Lasting sleep after operation, frequently making it unnecessary to use morphine for the relief of post-operative pain. 8 Amnesia. 9 Absence of injury after repeated administration (as in tetanus). 10. Rapid elimination (implying less toxic action).

Among the comments we have to offer on this list it should be said that it is hardly possible to overstress the value of the mitigation of "psychic shock." The integrative function of the nervous system plays so important a rôle in all physical activity that its protection becomes a matter of considerable account. This beneficial action is particularly noticeable in women patients. The diminution of respiratory complications is marked, and is especially valuable in abdominal and pelvic floor repair operations. The period of amnesia and post-operative analgesia lessens the suffering of the patients considerably.

The disadvantages mentioned in the report include a higher death rate than after ether. This still remains to be established, and we submit that a death rate of four per 734, i.e. 0.55 per cent, for gynæcological operations is not an unfavourable one. Depression of respiration and circulation (2 and 3) we have dealt with; and (4) acidosis, said to be as active as after chloroform, has not caused any trouble except its being possibly the cause of the severe headaches. The muscular relaxation said to be insufficient (5) was found here to be excellent. Falling back of the tongue (6) is met with the use of an airway, which is left *in situ* when the patient returns to bed, being fastened to the nightdress by a strip of bandage. The objection of lack of control from moment to moment is to be met with the reminder that avertin is a basal anæsthetic, and is to be used as such. Inhalation anæsthesia

is superadded to it and gives the necessary delicacy of control. The eighth disadvantage is the want of exact dosage, but a dose of 0.1 gm. per kilo body weight—varied, certainly, if there appears to be any special indication such as advanced cachexia,—would seem to be well within the margins of efficiency and safety. The alleged narrowness of the zone between fatal and anæsthetic dose (9) requires further definition, while the disadvantages "inherent in mixed narcosis" are probably more apparent to American readers than to those brought up in the Edinburgh tradition. We agree, however, that there is at present a lack of pharmacological investigation and exact knowledge as to the indications and contra-indications.

SUMMARY.

A series of 150 cases of avertin anæsthesia were observed, with special reference to the blood pressure changes. These were found to be greater than previously reported and, indeed, greater than would commonly be considered safe. At the same time no untoward results were observed, and similar changes are reported in young men exposed to very high external temperatures. These are discussed. From the experiences of the series the conclusion is drawn that avertin provides an advance in anæsthetic practice of prime importance.

I have to thank Dr. James Young, D.S.O., for permission to publish the clinical material. Part of the expense of the investigation was borne by a grant from the Moray Fund.

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Legend for Figures.

FIGURE 1.

The upper solid lines in each case represents the systolic blood pressure, the lower the diastolic, and the dotted lines the pulse rate. E marks the start of administration of ether; Ep the injection of ½ c.c. ephedrine hydrochloride; O the commencement of operative procedures, and F the finish of operation and removal of the patient to bed. The perpendicular line at the right of the curves indicates the pressure and pulse rates after 24 hours.

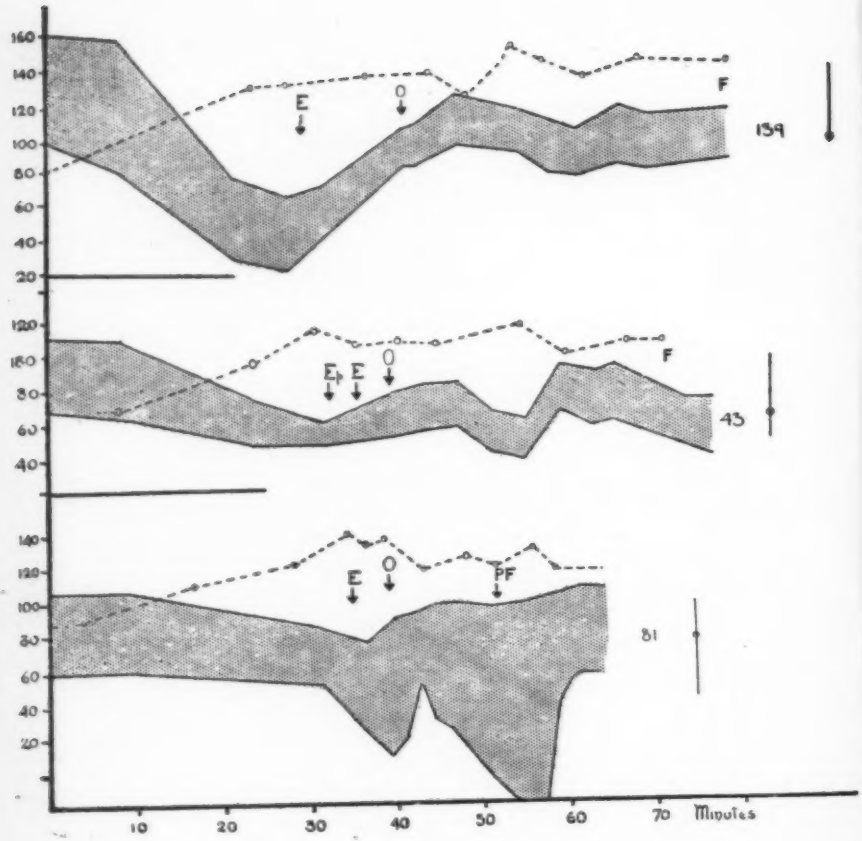
Case 139. Myomectomy; six ounces of ether. Case 43. Pelvic floor repair; six ounces of ether: the second fall coincided with the posterior part of the operation. Case 81. Removal of tents and clearing out uterus; one ounce of ether. The apparent fall of the diastolic to zero will be noticed (see text); ½ c.c. pituitrin was given at point marked P.

FIGURE 2.

Blood pressure changes on exposure of healthy young adult to great external heat. 1. Enters room at 119°F; 2. into room at 164°F.; 3. to room at 194°F.; 4. return to room at 164°F.; to cool room and massage; 6. pressure just after diving through cold pond, 58°F; 7. after half-hour's rest.

FIGURE 3.

Carotid blood pressure of cat; ether anæsthesia. At point A 13 c.c. 2½ solution of avertin was instilled into the rectum and the drum stopped for ten minutes. Each subsequent figure indicates stoppage and restarting of drum after 3, 3, 3, and 6 minutes. Ether was administered at point marked E. The horizontal lines indicate pressure of 120, 80 and 40 m.m. respectively; the lower curve is respiration.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70
Minutes

FIG. 1

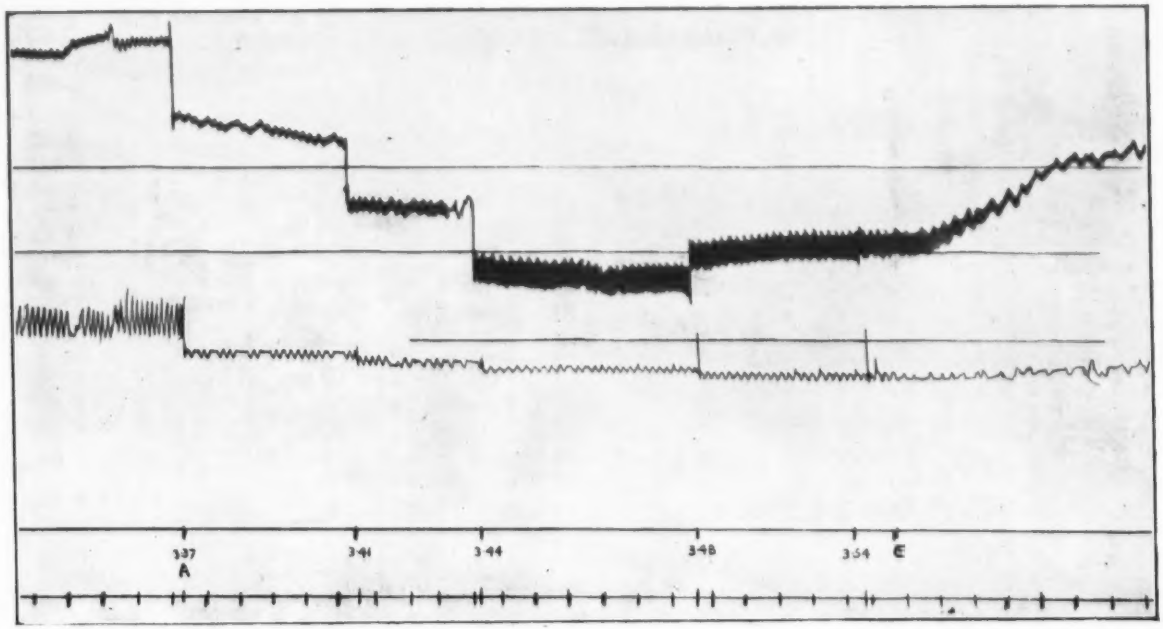

FIG. 3.

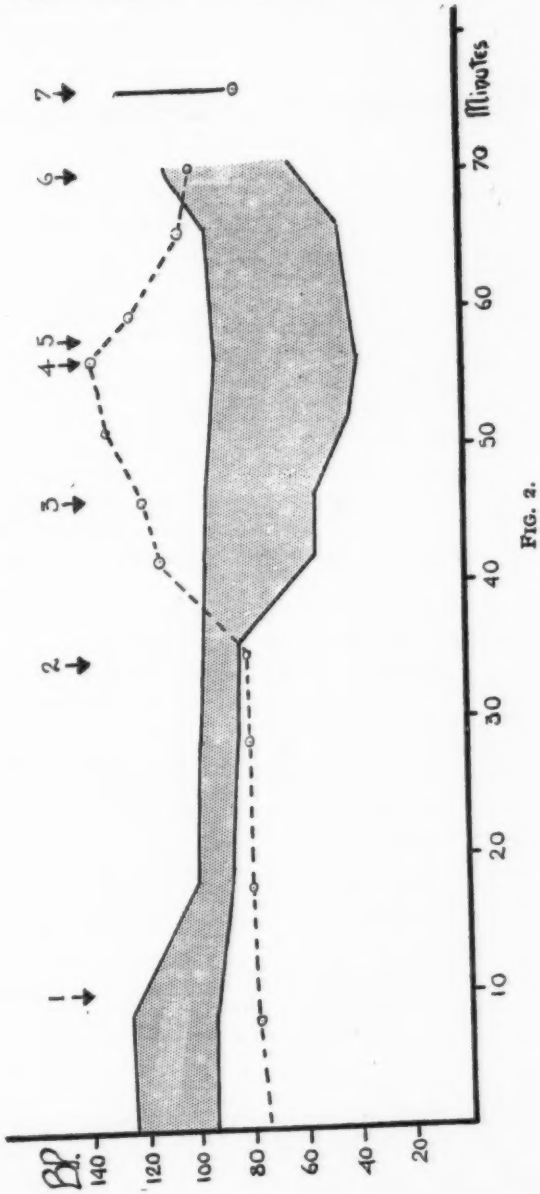

FIG. 2.

OBSERVATIONS ON PERCAIN SPINAL ANÆSTHESIA.

By KIRBY THOMAS, L.R.C.P., M.R.C.S.

Lecturer in Anæsthetics, University of Birmingham, etc.

IN his epoch-marking paper, recently published in this journal, Dr. Howard Jones has already blazed the trail for the exhibition of percain as a spinal anæsthetic. Any account, therefore, of my small experience with the drug must thus be considered as supplementary to, but definitely in accordance witht, the excellent results obtained by Dr. Jones.

Following his technique, I have used percain as a spinal anæsthetic in 80 cases, in two of which I successfully demonstrated the method before those members of the Surgical Section of the Royal Society of Medicine who attended at the Queen's Hospital during the meeting in Birmingham last June.

Of those 80 patients, 42 were males, and 38 females. The youngest was 20, and the oldest 79 years of age.

Pre-existing medical conditions present were—diabetes, 1; albuminuria, 1; chronic bronchitis, 3; asthma, 1; severe heart lesion, 5; one with definite fibrillation, several with marked asthenia, wasting and low blood pressure from chronic semi-starvation, while three of the appendicitis cases were suffering from severe toxæmia. Of the operations, 41 involved abdominal section.

There were:—

Cholecystectomy	8
Gastro-enterostomy	7
Gastrectomy	2
Resection of Intestine	3
Exploratory laporotomy	4
Excision of gastric ulcer	1
Fæcal fistula	1
Colostomy	2
Appendicectomy	13

The remaining included eight nephropexies, in five of which the vermiform appendix was removed through the lumbar incision, 15 herniæ—lumbar, ventral and inguinal—two prostatectomies, and various operations on the lower extremities.

In no case in the series was there any fault to find as regards complete muscular relaxation, but in five the anæsthesia was "patchy" and I had to give a little open ether, but in none of these was full anæsthesia required or effected. These partial failures were, I am sure, due to faulty technique.

Vomiting occurred in greater or less degree during traction on the stomach in some of the high abdominal operations, but always subsided when the clamps had been adjusted.

With the ordinary dose, anæsthesia usually persists for about five hours. The longest operation of my series, excision of a malignant growth of the descending colon, densely adherent to the posterior abdominal wall, took three hours. Anæsthesia up to the nipples was still present when the patient left the operating theatre.

Another case of interest, in view of the number of distinct operations performed, was that of a woman said to be suffering from cholelithiasis. On opening the abdomen, the gall bladder certainly was full of stones, but it was found that she also had a duodenal ulcer. Thereupon the surgeon set to work systematically and removed the vermiform appendix and gall bladder; he then did a gastro-enterostomy and finished off with an entero-enterostomy, the operations being completed in one and three-quarter hours. One other case was that of a stout old lady of 79. She was in a serious condition, having had complete intestinal obstruction for nine days, while both lung bases were solid with hypostatic congestion. It seemed any odds against her surviving an operation. Certainly inhalation anæsthesia was out of the question. After much difficulty, the cause of the obstruction was found to be an inoperable carcinoma of the rectum. Colotomy was then done, the whole proceedings taking just over an hour. To the mutual surprise of the surgeon and myself, she recovered without any serious symptoms and is still living. These three cases went through their operations perfectly quietly, but I do find in cases in which the operation

extends over an hour that there is a tendency to restlessness owing to one position being so long maintained, and to counteract this it is advisable to give a cerebral sedative about an hour before operation. Personally, I have been using allonal, but think there is room for improvement in this respect.

The percain solution I have been relying on is 1 in 1500 0.5 per cent saline of sp.g. 1.003—the amount iinjected varying from 10 to 20 c.c. according to the operation.

A fall in the blood pressure of from 10 to 20 m.m. occurred in 54 per cent of the cases, but returned to normal before the operation was over. In the other 46 per cent there was no alteration.

"Spinal headache" occurred with varying degrees of severity in the first 100 cases; since then there have only been two to report.

In two cases which died a week and ten days, respectively, after operation, the spinal cords showed nothing abnormal, either macroscopically or microscopically. The first of these had severe heart lesion, and died suddenly after pulmonary embolism. The other was in the last stage of cancer of the stomach. Gastro-enterostomy was done to try and relieve distressing vomiting, but this was only partially successful and she "faded away" on the tenth day after operation.

In conclusion, my experience shows that percain is a wonderful advance on any of the spinal analgesics used at present. It is less toxic—the period of anæsthesia is more prolonged—post-operative symptoms are practically absent, and post-operative shock is diminished.

I do not think the extent of the possibilities of percain spinal anæsthesia has yet been reached. I see no reason why, with correct technique, analgesia of the upper segment of the body should not be obtained, in a manner similar to that of Jonesco, twenty years ago, but I think with chances of greater uniform success than he had.

ON THE INFLUENCE OF ETHER ON THE TOXICITY OF NOVOCAINE

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THE use of novocaine together with ether in surgery in recent years made it seem likely that a study of the effect of ether upon the toxicity of novocaine would be of interest. The results obtained have been surprising, and may prove, perhaps, to throw some light upon practical problems. The present paper describes experiments on cats and mice. The experiments consisted in (1) the determination of the toxicity of novocaine intravenously; (2) the determination of the toxicity of novocaine (*a*) followed by ether, and (*b*) following ether.

EXPERIMENTAL. PART I. MICE.

(*a*) *Novocaine alone.* The novocaine used was a solution of the hydrochloride in 0.9 per cent saline. The mice used varied in weight between 20 and 30 grams; they were used without regard to sex. Injections were made into the tail vein, and the strength of the solution was adjusted so that the volume injected did not exceed 0.5 c.c. The time occupied in injecting the fluid varied between 15 and 30 seconds. In Table I are shown the results of the injection of novocaine alone. These results are plotted in Fig.I. The curve (No. 1) is of the S-shaped form.

(*b*) *Novocaine given before etherisation.* In carrying out the etherisation of the mice it was attempted to subject all the animals to the same concentration of ether. This was done by placing the injected animals, immediately after injection, into a bell-jar of about 3 litres capacity, containing 3 c.c. of ether. The amount of ether required was arrived at by a few

TABLE I.

Novocaine alone.

Dose per kg.	No. Mice	No. Dead	% Dead
0.085	10	10	100
0.080	10	9	90
0.075	11	9	82
0.070	26	6	23
0.068	21	2	9.5
0.045	10	0	0
0.040	10	0	0

preliminary experiments, and the volume chosen (3 c.c.) was such that the mice were anæsthetised in about three minutes and remained so for half an hour. This volume was found to be insufficient to kill any mice during the time alloted. Since all the animals of a group could not be injected at the same instant it is clear that the animals first injected received a slightly greater concentration of ether than those following. In order to minimise this difference the groups subjected to etherisation were limited to five animals. The time of etherisation was thirty minutes.

The result of this series of experiments was rather unexpected, as it was found that no injected animal died as a result of the etherisation. That is, the mice which died from any given injection did so very rapidly, as has been observed in the case of novocaine alone; they were, in fact, dead before they could be placed in the ether chamber. Those mice which survived more than a minute or two after the injection did so whether etherised or not. The toxicity curve of novocaine followed by ether is therefore identical (under the conditions of the experiment) with that of novocaine alone.

(*c*) *Novocaine administered after etherisation.* The etherisation was carried out as described above, with the difference that all the animals were subjected to the same initial concentration of ether; they were removed for injection one by one at the end of half an hour, and injected immediately with novocaine. The results are given in Table II, and are plotted Curve 2) in Fig. I.

TABLE II.

Dose per kg.	No. Mice	No. Dead	% Dead
0.070 gms.	17	17	100
0.068 ,,	22	22	100
0.060 ,,	14	13	93
0.045 ,,	14	10	71.5
0.040 ,,	17	12	70.5
0.030 ,,	10	6	60
0.020 ,,	20	6	30
0.015 ,,	10	1	10

It will be noticed that a very considerable effect has been produced both upon the shape and position of the curve. The points obtained lie upon a curve roughly of the S-shaped form, but very much less steep. Since the number of animals used in determining each point was not large (10 to 22) it is impossible to be sure of the precise shape of the curve. The chief interest lies in the very large effect exerted upon the position of the curve. Taking, arbitrarily, the point of 50 per cent mortality as a measure of the toxicity, the figures for the two curves are:

Novocaine alone - - 0.0725 gms. per kg.
,, after ether 0.025 ,, ,, ,,

A third curve (No. 3) is plotted showing the results of injections of novocaine a quarter of an hour after removing the mice from the ether chamber.

EXPERIMENTAL. PART II. CATS.

(*a*) *Novocaine alone.* In order to study the effects of etherisation upon the action of novocaine in cats, decerebrate animals were used. These preparations were arranged for recording blood pressure and respiration. A preliminary series of experiments was performed using decerebrate cats in order to determine the toxicity of novocaine without ether. A period of about one hour was allowed so that most of the ether absorbed by the cat during decerebration might be eliminated. It was found that the injection produced a rapid fall of blood pressure, with simultaneous arrest of respiration.

TABLE III.

No.	Sex	Weight in kgs.	Dose per kg.	Dose actual	Result
32	M	2.0	0.060 gms.	0.120 gms.	Died
31	M	3.0	0.055 ,,	0.165 ,,	,,
26	M	1.9	0.050 ,,	0.095 ,,	Recovered
22	F	2.4	0.050 ,,	0 120 ,,	,,
17	M	3.3	0.050 ,,	0.165 ,,	,,
14	F	2.2	0.055 ,,	0.121 ,,	Died
11	M	1.8	0.050 ,,	0.090 ,,	Recovered
10	F	2.0	0.045 ,,	0.090 ,,	,,
7	M	1.7	0.040 ,,	0.068 ,,	,,
6	M	2.9	0.035 ,,	0.101 ,,	,,
5	F	2.2	0.030 ,,	0.066 ,,	,,

(*b*) *Novocaine before etherisation.* From the results obtained with mice it was not anticipated that etherisation after the administration of sub-lethal doses of novocaine would produce any effect. This anticipation was found to be correct.

(*c*) *Novocaine after etherisation.* The animals in this series of experiments were decerebrated under ether, and a period of about one hour allowed so that most of the ether absorbed during decerebration might be eliminated. Ether was then administered by means of an intratracheal tube for a quarter of an hour. The ether given did not produce any effects visible in the tracing upon either the blood pressure or the respiration. The etherisation was then discontinued and novocaine administered. As will be seen in Table IV it was found that a dose of 0.050 gms. per kg. was fatal when given after etherisation. A dose of 0.040 gms. per kg. was found to be fatal, whereas a dose of 0.035 was not. The effect of ether upon the toxicity would appear to be less marked in cats than in mice. The blood pressure curves obtained closely resemble one another. There is, therefore, no difference detectable in the manner in which the drug acts when alone or in combination with ether.

TABLE IV.

Novocaine after Ether.

No.	Sex	Weight in kgs.	Dose per kg.	Dose actual	Result
15	F	1.58	0.050 gms.	0.079 gms.	Died
16	F	3.4	0.050 ,,	0.174 ,,	,,
20	F	1.6	0.040 ,,	0.064 ,,	,,
23	F	2.68	0.035 ,,	0.093 ,,	Recovered
27	F	2.58	0.040 ,,	0.103 ,,	Died

DISCUSSION.

Eggleston and Hatcher[1] found that the fatal dose for cats was 0.040–0.045 gms. per kg., giving the solution intravenously in 5–20 per cent solution. The difference between their figures and the one given above, viz. 0.050–0.055 gms. per kg., is presumably due to the fact that they used a solution ten times as strong as the one used in these experiments. They state[2] that the fatal dose (intravenous) of novocaine varies enormously with differences in the rate of administration of the dose. With this we are quite in agreement, and for this reason all intravenous injections were made at the same rate.

In considering the tracings it was found that there is a rapid fall of blood pressure at the moment of injection. This coincides with a complete cessation of respiration. The heart, however, continues to beat regularly with no visible alterations in rate or amplitude. In those cases where recovery occurred the cat made gasping inspirations, at first at long intervals, then increasingly rapidly. Corresponding to the respirations the blood pressure rises, finally returning to normal. The action of the novocaine is therefore primarily upon the respiratory centre, and death after fatal doses is due to respiratory failure; stoppage of the heart occurs only after a considerable period of apnœa. This result is in agreement with those of Frankfurther and Hirschfeld,[3] who stated that novocaine does not alter the heart's action and that the fall of blood pressure is due to dilatation of the vessels.

Summary and Conclusions.

1. No alteration in the toxicity of novocaine is found if ether is given after intravenous injection of novocaine.

2. A large increase in the toxicity of novocaine is found if the novocanie is administered intravenously after etherisation.

3. The increase in toxicity falls rapidly with increase in the time between etherisation and administration of novocaine.

4. The average fatal dose without ether is 0.090 gms. per kg. (mice).

5. The average fatal dose with ether is 0.025 gms. per kg. (mice).

6. The lethal dose for cats, without ether, is about 0.050 gms. per kg.

7. The lethal dose for cats, with ether, is about 0.040 gms. per kg.

8. In cats, intravenous injection of novocaine causes a marked effect upon respiration, which is coincident with a fall in blood pressure.

9. It would appear that ether causes no change on the seat of action of novocaine.

I am indebted to Professor E. C. Dodds for his kindness and hospitality. It is a great pleasure to acknowledge his help in criticising and advising me in this work.

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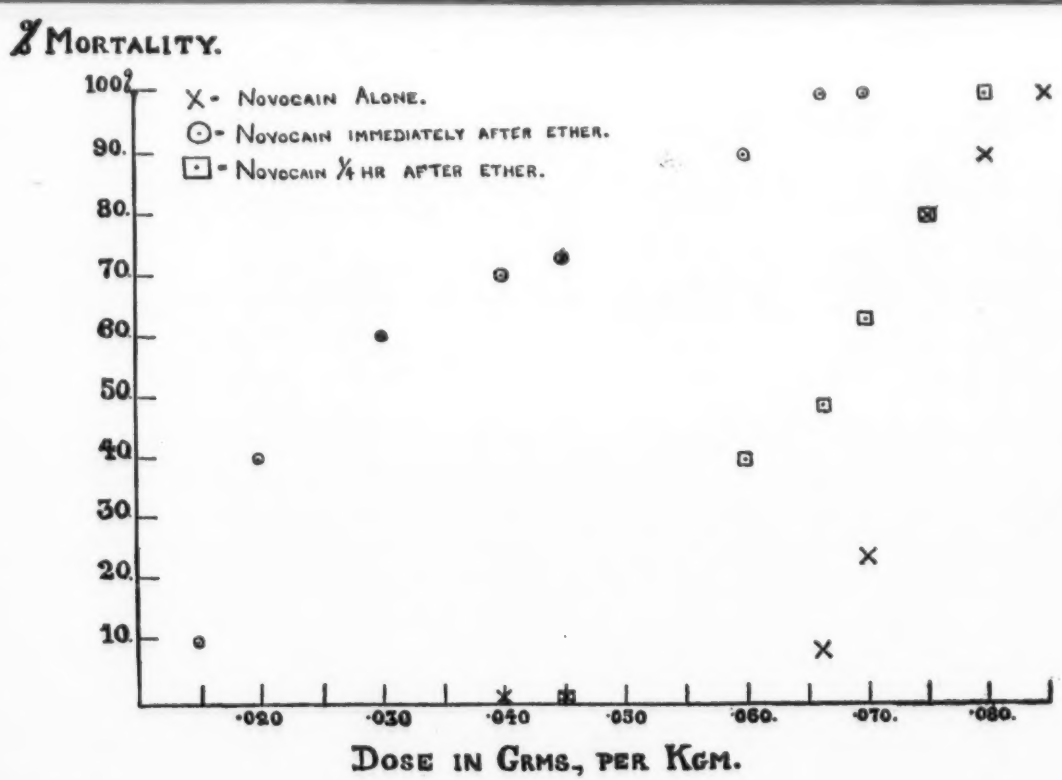
% Mortality.
100
90.
80.
70.
60.
50.
40.
30.
20.
10.
X- Novocain Alone.
⊙- Novocain immediately after ether.
⊡- Novocain ¼ hr after ether.
·020
·030
·040
·050
·060.
·070.
·080.
Dose in Grms., per Kgm.

Fig. 1.

SECTION OF ANÆSTHETICS.

(Royal Society of Medicine).

At the first meeting of the session on November 7th, H. W. Featherstone, M.D., the President, gave an account of his visit to some of the hospitals of Canada and to the Mayo clinic. The address was illustrated by lantern slides and was an entertaining and instructive account of both social and professional activities. At Montreal, Toronto, and Winnipeg he found atropine rarely given before anæsthesia; this appeared to be due to the dryness of the climate. Morphine and scopolamin were commonly used. Nitrous oxide was largely used, and ether is added liberally. Lundy, in the Mayo clinic, uses both ethylene and acetylene, the latter especially for thoracic work. Amytal is receiving much attention as a basal anæsthetic. With rapid injection œdema of the lungs may occur, and for this, intravenous injections of 50 per cent of glucose, atropine and administration of oxygen are recommended. The usual rate of injection is about one grain per minute, and the recovery period may be measured in hours per grain. The employment of novocaine crystals for spinal analgesia was in use at most of the clinics visited. Ampoules of 0.15 to 0.25 grs. in sterile crystalline form are provided. For a high abdominal case 10 c.c. of cerebrospinal fluid are used, with 0.25 grs. of novocaine; for the lower abdomen 0.15 grs. novocaine in 6 c.c. cerebrospinal fluid. For the upper abdomen the injection is made into the first lumbar space. The patient is put head down.

Mr. I. V. Magill had been so impressed with the results that he saw from the use of ethylene that he had altered his previous opinion that better effects could not be brought about with this agent than with nitrous oxide and oxygen. He had, too, witnessed remarkable success with spinal injections for high abdominal operations. Hiccough or nausea during spinal analgesia was treated with inhalations of CO_2 and oxygen. He had seen excellent results from the preliminary employment of embutal, a quantity of which he had received for trial.

Dr. H. P. Fairlie drew attention to the small place now held by open ether in anæsthetic practice in America, where, at his last visit, it was the routine anæsthetic. The use of the barbituric acid derivatives by the mouth appeared to open up most helpful possibilities.

ABSTRACTS.

Spinal Anæsthesia in the Near East. P. W. HARRISON. *Archives of Surgery,* October, 1930, pp. 582 et seq.

THE author has worked with all solutions of dextrose and of cane sugar. His anæsthetic drugs were tutocain and procaine, and using heavy solutions he gets different lengths of anæsthesia by varying the tilt of the patient by pillows and by a slanting support for the back. In order to meet the requirements of long operations he increased the viscosity of his solution (tutocain), believing that anæsthesia with tutocain is only slightly due to fixation of the drug in the tissues and that practically the anæsthesia lasts as long as the nerves involved are bathed in the solution and no longer. The quantity of the dextrose solution was accordingly raised to 5 c.c. and its concentration to 10 per cent. The dose of tutocain was 0.1 grm. Anæsthesia from this solution never failed to last 1¼ hours and usually 1½ hours. For upper abdominal operations and for double hernia operations needing a long time a solution of 5 c.c. of a 10 per cent solution of cane sugar (instead of dextrose) containing 5 grs. of procaine hydrochloride proved successful, giving anæsthesia always for two hours and sometimes longer. A needle with a diameter of 0.7 or 0.8 mm. should be used for this work. The author found that a spinal anæsthesia can be terminated very simply by injecting four ounces of 5 per cent salt solution intravenously. Anæsthesia produced by tutocain begins to fade within five minutes after this injection, and rapidly disappears. Anæsthesia from procaine begins to fade after twenty to twenty-five minutes. When eight ounces of the salt solution are injected the effect was more rapid, but severe reaction followed. The author relied on ephedrine for stabilising the blood pressure. He injected ¼ to one grain subcutaneously just before operating.

Epinephrine, however, he regards as a much more powerful drug: "Epinephrine plus elevation of the lower limbs has controlled every situation that I have encountered."

The author thinks that when Strauch's method of emulsifying epinephrine in a carefully adjusted medium is ready for general use, the problem of stabilizing the blood pressure during spinal anæsthesia will probably cause no more trouble.

In presenting the results of a further 2,302 administrations of spinal anæsthesia, Deaver and Eckels (*New England Journ. Med.*, October 16th, 1930) describe their routine technique, which includes the admission to the patient of a continuous flow of oxygen. This is

administered through a soft rubber tube inserted just inside one nostril and is started as soon as the anæsthesia has been obtained. The authors claim for the proceeding is that a useful psychic effect is obtained, the patient welcoming some "gas," and also that nausea is to some extent prevented by the oxygen.

The Combination of Avertin and Laughing Gas. H. FLORCKEN, *Medizin. Klinic.* October 12th, 1930.

The avertin is given half an hour before operation, no other preparative being used. In a 2½ per cent solution a dose of less than 0.1 gr. per kilo is employed. The gas oxygen is given as soon as the patient is on the operating table and is started with 20 per cent of oxygen. A small ether addition was needed in five cases. There were 80 operations for gallstones, 52 stomach resections and ten nephrectomies in the list, which included also operations for Graves' disease and thoracoplasties and prostectomies. Jaundice in the patient was not regarded as a contraindication. Post-operative troubles weere few and slight, and the author regards the combination of avertin and nitrous oxide as the best existing general anæsthetic.

Intravenous Anæsthesia with the Barbiturates. D. E. TABERN, *Clin. Med. and Surg.* Vol. 37, No. 11, pp. 810 etc.

Nembutal and amytal, according to the author, almost completely decomposed in the body, and this is associated with their extreme effectiveness. Post-operative sleep and post-operative excitement are less with nembutal than with amytal. Lundy has reported on 403 cases treated with nembutal and regards it as twice as effective as amytal with a recovery period of half the length of that after amytal. A further 800 administrations of nembutal have been carried out. Administered orally or rectally, instead of into a vein, nembutal is equally effective, but the onset of effects is slower. Three grams are given an hour before operation. After some time morphia gr. ⅙ and atropine gr. 1/300 are given. If any further anæsthetic is needed the amount (of ether, nitrous oxide, etc.) is reduced to about one third of what would be otherwise required.

The Variations of Lipæmia in Chloroform and Ether Narcosis. Annali Italian di Chirurg. September 30th, 1930.

A. A. Chiariello has studied the variations in the fat contents of the blood following anæsthesias of varying lengths with both chloroform and ether. As regards chloroform he found that a hyperlipæmia occurs, largely due to an increase in the percentage of free chlosterin and neutral fats. This increase is not constant, showing great variation. The other fat contents increase in similar ratios except

for the soaps, which nearly always vary inversely. For ether there are no notable differences from the above findings except that the increase in total cholesterin is largely in the cholesterol esters rather than in the free cholesterol, which would suggest a more marked reaction of the antitoxic powers of the body.

A new local Anæsthetic: Chlorhydrate of "pseudo-cocaine droite." MERCIER and REQUIER. *Revue de Stomatologie.* Sept., 1930.

"Pseudo-cocaine droite" was prepared synthetically by Willstatter. Gottlieb's experimental work showed the salt to be less toxic than cocaine but possessed of greater anæsthetic power. The authors claim that experimentally it is 2½ to 3 times as strong an anæsthetic as cocaine, that in practice its anæsthetic effect on mucous membranes and on nerve trunks is equal to that of cocaine, and that its toxicity is only as 1 to 2½ compared with that of cocaine. The drug has no stupefying power. The authors believe that chlorhydrate of pseudo-cocaine droite is destined to replace the usual cocaine.

Anæsthesia for Operations upon the Gravid Uterus. H. W. FEATHERSTONE. *Canadian Med. Assoc. Journ.* October, 1930, pp. 505 etc.

Fibroid tumours, particularly those of the cervix, and simple ovarian cysts may obstruct the pelvic cavity. Removal of the tumours is often a matter of considerable operative difficulty. The aims of the anæsthetist are, therefore, abdominal relaxation, avoidance of circulatory congestion and oozing from cyanosis, and the least possible disturbance of the liver and kidney functions. Perhaps the best compromise is obtained with chloroform, or a mixture of chloroform with ether. Gas-oxygen does not give sufficient relaxation and the resulting tension and pressure on the uterus may produce an intrauterine hæmatoma, resulting in a miscarriage. Spinal analgesia is useful because it regulates the bleeding. The author approves this latter method also in the presence of severe heart disease in a patient undergoing normal labour. He injects at the beginning of the second stage when the os is fully dilated and expulsive pains are strong. In normal labour, generally, he finds chloroform the most useful anæsthetic, gas-oxygen the safest. For emptying the uterus by direct operation, as in evacuating an immature fœtus, mole or other retained products of gestation, spinal analgesia has special value. There is danger with these patients of post-operative hæmorrhage. With spinal anæsthesia up to the level of the umbilicus strong toxic contraction of the uterus is the rule and the loss of blood is consequently small. The author and Whitehouse have produced evidence experimentally to show that spinal analgesia produces strong contractions of the circular fibres of the uterine

muscle. This gripping effect of the uterus explains the failure of spinal analgesia to allow expulsion of the uterine contents when given for miscarriage or labour.

Avertin for Children. Schmerz, Narkose-Anæsth., Sept., 1930.

The author has used a 2 per cent solution and given a dosage of 0.125 per kilo in 130 cases. He is perfectly satisfied with results, both as to anæsthesia and after effects, and his youngest patient was six months old. Operation is begun 20 to 30 minutes after the injection and he regards the anæsthesia for operation as lasting about one hour. In 54 of the cases no additional anæsthetic was required; in others small amounts of ether were used. The author found that fat children do not react so favourably as thin ones.

Scopolamin-Endokol-Ephetonin in Ophthalmic Work. Schmerz, Narkose-Anæsth., September, 1930.

The author has used subcutaneous injections of the above combination to bring about a "twilight sleep" during which ophthalmic operations can be performed. Thirty cases have been successfully conducted. The endokol replaces morphia and the ephetonin has the same effect as ephedrine.

Sodium Amytal in Intravenous Anæsthesia. New England Journ. of Med., November, 1930.

The author reports a hundred cases, in 95 of which the amytal was supplemented by nitrous oxide or ether. A post-operative drowsiness of eight to twenty-four hours was seen in all patients. Nausea and vomiting occurred only twice. Meniceal delirium followed once. The writer concludes that amytal alone is only serviceable as an anæsthetic in the old or weakened. In combination it reduces the amount of other anæsthetics by 20 to 80 per cent. In cardiac conditions it has saved life. No pre-operative narcotic or hypnotic should be used.

CORRESPONDENCE.

To the Editor of the "British Journal of Anæsthesia."

Dear Sir,

Apropos of Mr. George Edwards' article and the leading article on emergency anæsthetic work in the last issue of the *Journal*, it may interest your readers to know of the arrangements which have been made to meet this difficult problem at the Manchester Royal Infirmary.

Firstly we have at the Manchester Infirmary an Anæsthetic Sub-committee of the Board, cnosisting of seven members. S. R. Wilson was the first representative on this committee; then I followed and was successful in getting two of my colleagues on, in place of two physicians.

I suggested, in 1924, that we should offer to go down to the Infirmary to *supervise* the new house surgeons whilst anæsthetising their first twelve urgencies. The Board at once approved and offered us a lump sum each year; later it was altered to £1. 11s. 6d. per case.

We then suggested that the residents were generally left with the most awkward urgencies to anæsthetise, and we now attend for administration or consultation when called upon by the resident or assistant resident officers, and are paid for these and the house-surgeon supervision cases at the rate of £1. 11s. 6d. each.

There are seven anæsthetists at the Infirmary and we have each a definite day for being called upon. As our hospital work is done in the mornings our urgency day starts at 1 p.m. until 9 a.m. the following morning. The work is quite optional, and if one anæsthetist cannot attend the anæsthetist of the following day is called.

There is no limit to the number of cases, and anæsthetists have been known to administer or supervise as many as ten cases on one day.

The Infirmary Board said that they did not mind spending the extra money if the mortality was checked, although, as a

matter of fact, our mortality percentage was very good. However, our figures during the last few years have improved.

We all live fairly near to the Infirmary and any of us could get there in ten minutes after receiving a call.

The figures for the last two years, to September 30, 1930, are as follows:

September 30th, 1928 to September 30th, 1929.		September 30th, 1929 to September 30th, 1930.	
Urgencies - - - -	233	Urgencies - - - -	279
House surgeon instruction urgencies -	305	House surgeon instruction urgencies -	257
Total	538	Total	536

The twelve urgencies which each new house-man has to administer under supervision give them much more confidence, and we generally get each man through in about ten days.

Yours truly,

EDWARD MOIR.

(*Senior Anæsthetist.*)

N.B.

We have much pleasure in publishing Mr. Moir's letter, as it appears to us that the arrangements of the Manchester Infirmary to deal with emergency anæsthetic work are admirable, and might be imitated with advantage by many large institutions both in London and throughout the country.

(Ed. *B.J.A.*)